The Canadian Entomologist.

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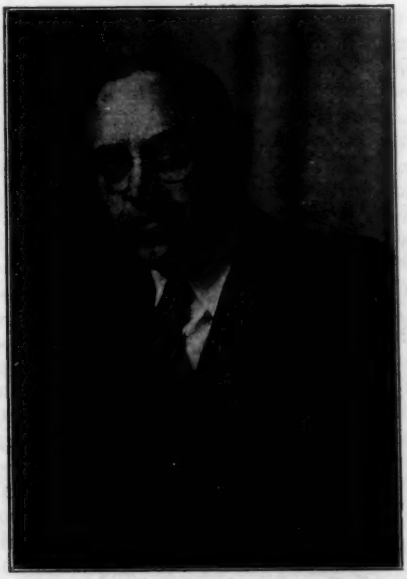
CANADIAN ENTOMOLOGIST AWARDED MEDAL

The medal, which may be awarded each year by The Professional Institute of the Civil Service of Canada for the most outstanding contribution by professional or technical workers or groups of workers belonging to the Dominion or Provincial Civil Services in Canada, in science, economics, administration, and associated fields of endeavour, was presented on November 28th to H. L. Seamans and those associated with him at the Dominion Entomological Laboratory at Lethbridge, Alberta, in recognition of the work upon the control of the pale western cutworm, *Agrotis orthogonia* Morr.



H. L. SEAMANS

The award was made by a committee of judges consisting of Dr. H. M. Tory, President-emeritus of the University of Alberta and President-emeritus of the National Research Council of Canada, Sir Robert A. Falconer, President-emeritus of the University of Toronto, and Augustin Frigon, Assistant General Manager of the Canadian Broadcasting Corporation. The medal was presented to Mr. Seamans at the annual luncheon of the Society and the formal presentation was followed by a public statement of congratulation and commendation by the Right Honourable William Lyon Mackenzie King, Prime Minister of Canada.

Mr. Seamans, who is officer in charge of the Dominion Entomological laboratory of the Dominion Department of Agriculture at Lethbridge, was born in Wauwatosa, Wis., in 1891. He graduated with a B.Sc. degree from Montana State College in 1916 and was accorded the M.Sc. degree by the University of

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Saskatchewan in 1933. He served in the United States Army from 1917 to 1919 and has held the positions of Assistant State Entomologist of Montana, Special Field Investigator of the United States Department of Agriculture, and Assistant Professor of Zoology of Montana State College.

Mr. Seamans came to Canada in 1921 to take charge of the work of the Entomological Laboratory at Lethbridge. Among the major problems under investigation at this laboratory has been a study of the pale western cutworm. The investigations by Mr. Seamans of this insect began in Montana, preceding his Canadian appointment, and have been continued since. The practical results of the study include the successful forecasting of outbreaks of the insect a year in advance, the avoidance by cultural means of infestations in fields to be cropped, and the development of the so-called "starvation method" for the control of this pest in fields known to be infested.

THE TERMITE, AN OBJECT LESSON

By Ernest N. Cory
College Park, Maryland

Most of the information in regard to termites has come as a result of efforts to combat their destructive activities. In these studies an amazing story of social organization and biological adaptation that has fascinated students in sociology, political science, and engineering, as well as entomologists, has been unfolded.

Classes working in harmony for a common good rather than arrayed against each other for selfish ends gives the sociologist something to think about. Order, colony protection, sustenance, and control of population exemplifies political economy of the highest order. The structural strength of some termitaria can well be compared with structures of steel and concrete; and air conditioning, the latest hobby of engineers, was an old story to termites before man appeared on this earth.

Biologically, the termite story is replete with items of interest. Many special adaptations in structure, physiology, and habits occur in the tropical forms; but, since we are more familiar with the native *Reticulitermes flavipes* Kollar, this account of the biology of termites will be confined to that species.

The colony starts with a single pair, the winged male and female. This pair comes from a swarm, usually cast in spring, though occasionally fall swarms occur. Enormous numbers of winged males and females emerge from their dark cavities into the light of the outer world. An insect colony that is normally positively thigmotropic and negatively phototropic produces each spring thousands of winged, pigmented migrants that have for a short period of hours a reversal of their usual tropisms. They hurry forth into the light from the narrow confines of the galleries, seek mates, and in a few hours again reverse their tropic behaviour by returning to a dark space beneath a stone or log, there to remain for the balance of their lives. What motivates the production of swarms of males and females or how the sex is controlled are still unsolved problems. If dictators, by decree, could determine what proportion of human offspring should be males and which of those should be workers or soldiers, their problems would be vastly simplified. The termite colony does this with exactitude.

The pair under the stone drop their wings, mate, and start the new colony. During the early stages the male and female enlarge the cavity for the reception of the eggs that the female begins to produce. They feed the newly hatched young, which at first are all workers, and when they mature the duties of the household are taken over by them. More workers follow and finally, during the course of a year, some soldiers or defenders of the colony are produced, the total members amounting to about fifty. In the next year, the rate of increase

multiplies enormously and soon there is a populous colony, mostly of workers that fare forth seeking wood for food. Wood is largely cellulose, a material that most animals cannot convert to their bodily uses; but termites, by reason of remarkable symbiotic relationships, are able to digest this otherwise indigestible material. In their intestinal tract are numerous one-celled animals and other organisms that break down the cellulose into materials that can be assimilated by the termites. In the absence of these symbionts, the animal will starve. Most likely, the winged males and females carry the inoculum from the parent nest and supply the first workers that hatch with the initial culture; and they in turn inoculate the other termites as they hatch.

The ingenuity and persistence of the worker termite in locating suitable wood for food and in maintaining contact with moisture, which is necessary for the life of the colony, is truly remarkable. They will build shelter tubes of chewed wood, excrement, and saliva over intervening stone or conrete in order to reach wood without exposure to light. These shelter tubes are usually attached to the foundation, but there are many cases on record where hanging tubes have been constructed two or three feet in length from an infested beam to the earth.

Meanwhile the original mother of the colony continues to produce eggs at an unbelievably rapid rate, calculated by Escherich for an African species to be thirty thousand eggs a day or one hundred million in the average ten year life span. Without waiting until her fecundity has been reduced, she provides for a continuation of the colony at an undiminished rate by the production of primary, secondary, and even tertiary reproductives, each capable of reproduction, but probably limited to a particular caste. Special defensive forms, known as *nasuti* from the prolongation of the head into a snout, bearing glands that secrete a repellent substance, supplement the true soldiers armed with large mandibles.

Continuous reproduction, an assured food supply, defensive methods of a high order, and a complete division of labor practically insures colony immortality, if man's interference is left out of the reckoning.

Biologically, socially, and politically, the termite offers an object lesson to man that is of special importance at this time when so many philosophies of government are being tried or discussed.

Government has progressed through many stages. Originally the "Divine Right" of kings to rule was the prevailing basis of government. In time this was challenged, and a contract form of government was substituted in which the power to coerce the people was delegated to representatives. This power to coerce has its ethical justification in the value that may be assumed for collective or individual welfare and happiness. In delegating the governmental powers, the individual, in democratic forms of government, reserves to himself the right of freedom of thought and independence of action, insofar as such action does not interfere with similar rights of others. To this extent the powers of the sovereign state are prescribed, but coercion extending to every phase of private and social life, religion, art, and individual welfare is the ideal of the totalitarian state. The termite colony exemplifies the totalitarian concept of government towards which dictatorships tend. A clear understanding of all the implications in such a form of government is essential if we are to reach a sound judgement as to the future of humanity.

Communism and Facism approach the totalitarian philosophy of government. Communism is generally conceded to be a dictatorship of labor; Facism is apparently a dictatorship of capital. Due to inherent selfish motives, it is questionable whether any dictatorship can achieve the unselfish ideals of the totalitarian state; yet every extension of the coercive powers of government is

a step toward the loss of individuality and a termite-like existence for which, biologically at least, humanity is not equipped.

We must choose between the development of the individual, materially and spiritually, or the subjugation of the individual for the welfare of the state as in the termite colony, with the individual of no moment except as it contributes to the good of the organization.

This is the outstanding object lesson that entomologists can point out to the public; an insect Utopia complete in every function; an insect Utopia that has been working smoothly for millions of years; an Utopia that mirrors the life of humanity as it would be if the totalitarian philosophy is allowed to permeate by easy stages, business, social and political activities.

STUDIES ON REPELLENTS FOR BITING FLIES*

By C. G. MacNay

Ottawa, Ont.

In view of the known lack of effectiveness and doubtful value of many of the materials cited in literature as being of value as repellents for biting flies, a series of experiments was carried out at the direction of the Dominion Entomologist, during the past three seasons, with the object of determining which of the many materials recommended as repellents might be the most effective and which the most lasting in effect.

Some forty or more recommended materials and formulae of promise, exclusive of proprietary mixtures, have been found recorded from the literature reviewed. No attempt has been made to make a comparison of these, but rather a list of all active ingredients which could be regarded as potential repellents or masks was made from the data, inert carrier substances being excluded. Names of a few more materials, personally selected as having possible value as repellants, were added to the list.

Using this list as a basis, a beginning was made in an extended series of comparative tests, on a time basis, of the various materials listed, the object of these tests being to eliminate all materials of little promise and to determine which materials would give protection for relatively long periods of time. No extensive experimental work with carrier materials for prolonging periods of protection was carried out.

In the early stages of the work, repellent materials were tested without dilution in any carrier. Since some of the very volatile materials proved very effective for the short time they lasted, it was decided that comparative tests of repellent materials alone do not, from a time basis, give a true comparison of their repellent efficiency, but rather to a much greater extent, their degree of volatility. For this reason, all materials subsequently tested were incorporated in olive oil, and, with few exceptions, on an equal parts basis.

Before deciding upon olive oil as a common carrier, a preliminary test was carried out with petrolatum, olive oil, castor oil and glycerine to determine their lasting properties when applied to the skin. Castor oil proved the most lasting, glycerine fell in second place, olive oil third, and petrolatum last. Olive oil was chosen for the following reasons: (1) It was found to last sufficiently long for experimental purposes, namely, the elimination of the majority of materials tested, yet not long enough to slow up the work unduly. (2) It was fairly easily removed with soap and water. (3) It proved effective in neutralizing the burning effect upon the skin of many of the materials tested, thus alleviating much discomfort and temporary injury which might impede experimental work.

*Contribution from the Division of Entomology, Department of Agriculture, Ottawa.

Experiments in 1936 indicated oil of tar to be a very effective repellent but it is so dirty and messy in use that it has never been very popular as an ingredient of repellent applications. In view of this, an effort was made to remove from a sample of oil of tar the dark colouring matter which is largely responsible for its dirty appearance and staining of clothing. F. A. Herman, of the Division of Chemistry, Central Experimental Farm, was able, by a series of fractional distillations, to divide the sample into four parts, two of which were nearly clear, a third part being slightly brownish in colour but which imparted no appreciable colour to the skin when applied with a carrier oil, and a fourth part or residue which was in appearance a black, thick liquid not at all desirable for application as a repellent. Practical repellent tests of the first three distillation products incorporated in equal quantities of olive oil indicated all three to be superior in repellence to the original sample of tar oil. It is not expected, however, that if applied alone they would be as lasting in effect as the original sample since the coloured residue had a very heavy consistency, but any clean carrier such as olive oil or castor oil should, and apparently does, act as an efficient substitute for the coloured residue in prolonging the period of protection.

In carrying out the tests of repellent materials, a head net was worn to protect the face; arms were exposed from wrists to a couple of inches above the elbows and rubber gloves worn. The latter were used since, in tests carried out last season, "first bites" upon which experiments are timed were often received on fingers and knuckles and it was believed that these resulted from an uneven protective film and some thinning out at the knuckles due to the handling of materials and flexing of the fingers while making notes. A three minute check count of bites on exposed arms was made immediately prior to each repellent test to determine the intensity of the infestation and to make sure that the insects were biting in numbers. Gloves were then removed, a vial containing 4 cc. of repellent material opened and approximately half of the contents (2 cc.) rubbed on each arm with the palm of the hand and fingers from wrists to two or three inches above the elbows. In some cases different materials were placed on either arm. Gloves were then replaced and the date, time of day, shade temperature, relative humidity, cloudiness, wind direction and approximate velocity, nature of environment, and effect of the material on the skin noted. Throughout each test, the writer moved about a little but remained in the immediate vicinity of the place where the experiment was commenced. By the time four or five bites were received and recorded, the experiment was terminated, the material washed off with soap and water, and the arms dried and allowed to air for fifteen minutes or longer before commencement of another test. All tests were carried out upon the writer, which should tend to result in a more accurate comparison of materials than if different individuals had taken part in the tests. The work was carried on in fairly densely wooded areas in close proximity to river flats and to areas partially covered by bodies of surface water in early spring. Species of mosquitoes prevalent during the tests were chiefly *Aedes hirsuteron* and *A. stimulans*, while *A. vexans* and *A. trichurus* were present in moderate numbers along with a scattered infestation of a few other species.

RESULTS

In the accompanying table, the materials tested are listed in order of merit based upon the length of time during which each gave one hundred per cent protection. Many, such as pyrethrum extract, tar oil and its distillation products, pine oil, and others, continued to give fair protection for varying lengths of time in excess of those recorded in the table, while others gave perfect protection for a period, then very quickly became quite ineffective. The number of tests given each material varies from one to six, the majority getting only

one or two tests; for this reason, the order in which they are placed is quite tentative and would doubtless be altered considerably if experimentation could be continued. It would be necessary to give each material ten or twelve tests at various times and under varying conditions in order to obtain a fairly accurate comparison of the repellent values of the materials tested. The list as it stands, however, gives a general comparison and should be of use in that it shows many materials of little value which can be eliminated from further tests.

When repellent materials were applied and tested in the open, the results were influenced by two main factors: weather conditions and the time at which the tests were carried out. Both of these factors affect the behaviour of mosquitoes. A third factor, namely, the difference in attractiveness of individuals to mosquitoes, which ordinarily has to be taken into consideration, does not enter into the problem in this case, since all tests were carried out by a single individual.

The weather factor is an important one since mosquitoes in their activities are greatly influenced by even minor changes. Results published by Rudolfs dealing with the behaviour of salt marsh (7) and house (8) mosquitoes under different atmospheric conditions indicate the effects of such factors as wind and temperature. In his studies, he kept records of the date, time of day, temperature, atmospheric pressure, relative humidity, wind direction and relative velocity, cloudiness and rainfall. In one instance, he reported that when a thunder storm came up on the horizon but did not approach the locality in which the experiments were being carried out, the mosquitoes changed in the course of an hour or so from comparatively inactive to strongly attacking, and apparently very hungry individuals, and a little later were as inactive as they had been previously. Similar instances were frequently noted in the course of my own wark, but it was often difficult to link up the change in activity with the activating force.

The second factor mentioned as having an influence on the results obtained, namely, the time of day or of the season, is also an important one. Mosquito activity varies greatly throughout a single day and throughout the period of a month or more during which experiments might be carried out. It follows, therefore, that a material tested at a time when mosquitoes are comparatively quiet is very likely to indicate a longer protection period than it would if tested at a time of maximum activity. Density of population is also a factor very likely to have a noticeable effect on results, especially when different substances are tested at extremes of population density. The influence of these various factors upon results can be offset only by frequent repetition of tests each season and for several seasons. The marked deviation of results in some instances, where a single material was given two or more tests at different times and under different conditions, is evident in the accompanying table and emphasizes the need for repetition of tests to offset the effects of the various factors noted as influencing results.

Pyrethrum extract in addition to giving promise as a repellent has a marked effect upon mosquitoes alighting on the skin when the repellent effect begins to abate. Many fly away without attempting to feed; later, others puncture the skin or even fully insert the proboscis, then attempt to fly away without having fed. If the insects remain any appreciable length of time upon the skin, the pyrethrum seems to stupefy and, to a considerable extent, paralyze them, the paralysis being noticed chiefly in the legs which usually buckle and lose their power to support the body which sags. The proboscis is withdrawn and usually curved in an unnatural position beneath the body. In several instances, struggles of the mosquito to escape resulted in autotomy, and in one case, all the legs separated from the body. Separation appeared to occur at the junction of the femur and trochanter. Rudolfs (3) reports that in all cases of autotomy

REPELLENT ACTION OF VARIOUS MATERIALS AGAINST COMMON SPECIES OF AEDES

Date 1937		Material	Shade Temp. F.	Rel. Hum.	Wind	Cloudiness	No. of Bites in 3 min check	Time Test Commenced	Time Before Biting (min)	Average
1	VII	Pyrethrum extract	69	59	Mod. breeze	patchy	15	10.15 a.m.	305	
8	VI	" "	64	66	Calm		52	9.40 a.m.	370	
31	V	" "	88	71	Strong breeze	patchy cumulus	23	2.45 p.m.	90*	
22	VI	" "	68	69	Strong wind	scattered cumulus	26	11.35 a.m.	180	
25	VI	" "	72	73	Calm	clear	18	10.15 a.m.	265	
1	VII	" " (1)	69	59	Mod. breeze	patchy	15	10.15 a.m.	270	278
16	VI	Thyme	68	63	Mod. breeze		17	10.30 a.m.	195	
15	VI	"	63	42	Light breeze		25	9.45 a.m.	260	227.5
1	VI	Tar oil distil. No. II	80	51	Light breeze	clear	23	1.30 p.m.	225	225
25	VI	Thymol (2)	80	44	Calm	clear	17	1.40 p.m.	180	
24	VI	"	72	65	Calm	clear	17	10.10 a.m.	210	195
29	VI	Pyrethrum-thyme (3)	65	85	Light breeze	heavy cumulus	21	10.15 a.m.	215	
28	VI	" "	69	79	Calm	overcast, rain	15	2.30 p.m.	150	182.5
15	VI	Geranium bourbon	63	42	Light breeze		25	9.40 a.m.	180	180
16	VI	Geraniol	74	66	Light breeze		27	3.40 p.m.	125*	
17	VI	"	73	54	Calm	overcast	27	12.20 p.m.	175	175
11	VI	Cinnamic aldehyde	68	47	Calm		9	9.20 a.m.	165*	165
25	VI	Phenyl salicylate (4)	72	73	Calm	clear	18	10.15 a.m.	150	
24	VI	" "	79	31	Calm	clear	20	3.30 p.m.	130	140
19	VI	Bay laurel	67	71	Calm	clear	27	11.35 a.m.	100*	
21	VI	" "	75	72	Light breeze	patchy	17	9.25 a.m.	135	135
14	VI	Cresol	70	64	Calm		19	10.15 a.m.	135	135
29	VI	Pamph. No. 55 (5)	68	74	Light breeze	heavy cumulus	21	11.45 a.m.	130	130
24	VI	Tar oil dist. No. III	72	65	Calm	clear	17	10.15 a.m.	130	130
11	VI	Pine oil	79	38	Light breeze		26	2.40 p.m.	95	
16	VI	" "	68	63	Fresh breeze		17	10.35 a.m	140	117.5
1	VI	Clove	62	64	Calm	clear	26	7.20 p.m.	120*	120
14	VI	Tar oil dist. 1	76	55	Calm		36	4.00 p.m.	110	110
11	VI	Citronella-spike (6)	68	47	Calm		9	10.10 a.m.	110	110
17	VI	Citronella	73	54	Calm	heavy cumulus	27	12.25 p.m.	95	
14	VI	"	76	55	Light breeze		12	2.05 p.m.	120	107.5

*Test terminated by rain, etc.

REPELLENT ACTION OF VARIOUS MATERIALS AGAINST COMMON SPECIES OF AEDES—*Continued*

Date 1937	Material	Shade Temp. F.	Rel. Hum.	Wind	Cloudiness	No. of Bites in 3 min check	Time Test Commenced	Time Before Biting (min)	Average
14 VI	Tar oil (rectified)	75	59	Calm		18	12.55 p.m.	125	
21 VI	" " "	80	51	Light breeze	clear	23	1.35 p.m.	60	92.5
28 VI	Pamph. 55 (7)	69	79	Calm	cumulus, rain	15	2.35 p.m.	85	85
16 VI	Citral	74	66	Light breeze		27	3.30 p.m.	90	
24 VI	"	78	40	Calm	clear	21	2.10 p.m.	80	85
29 V	Cedar	73	54	Light breeze	clear	22	11.15 a.m.	85	85
2 VI	Bitter orange	73	36	Calm	clear	12	3.10 p.m.	85	85
21 VI	Geranyl acetate	75	72	Light breeze		17	9.30 a.m.	75	
24 VI	" "	79	31	Calm	clear	20	3.40 p.m.	90	82.5
19 VI	Hedeoma	67	71	Calm		27	11.05 a.m.	65	
22 VI	"	70	66	Fresh breeze	clear	19	3.30 p.m.	80	72.5
11 VI	Benzyl alcohol	79	38	Light		26	2.45 p.m.	55	
15 VI	" "	71	38	Calm		10	4.00 p.m.	75	65
25 VI	Sweet almond	80	47	Calm	clear	14	3.20 p.m.	60	60
14 VI	Anethol	70	64	Calm		19	10.10 a.m.	65	
15 VI	"	71	38	Calm		10	4.00 p.m.	50	57.5
29 VI	Pamph. 55 (8)	65	85	Light breeze	cumulus	21	10.15 a.m.	55	55
14 VI	Camphor (9)	75	59	Calm		18	12.30 p.m.	45	
4 VI	"	62	69	Light breeze		7	11.10 a.m.	65	55
16 VI	Spike	72	61	Fresh breeze		22	2.30 p.m.	40	40
19 VI	Nutmeg	66	71	Calm	cirrus cl.	30	9.30 a.m.	25	
22 VI	"	70	66	Fresh breeze	cirrus cl.	12	1.35 p.m.	45	35
24 VI	Hemlock	78	40	Calm	clear	21	2.10 p.m.	40	
21 VI	"	78	57	Light breeze	clear	18	11.25 a.m.	30	35
19 VI	Amyl salicylate	66	71	Calm	clear	30	9.25 a.m.	35	
22 VI	" "	68	69	Strong wind	scattered cl.	26	11.40 a.m.	35	35
25 V	Terebinth	72	54	Light breeze	clear	22	3.55 p.m.	35	35
7 VI	Caprylic alcohol	78	40	Light breeze		15	4.05 p.m.	20	20
19 VI	Olive oil (check)	67	71	Calm		27	11.10 a.m.	15	15
29 V	Paradichlorobenzene (10)	70	56	Light breeze	clear	27	10.10 a.m.	15	15
7 VI	Eucalyptus	77	39	Calm		33	3.20 p.m.	10	10

(several hundred) observed in his studies, the rupture occurred at the base of the femur and the end of the trochanter. Exposure to quite a variety of substances may bring about this condition.

The accompanying table summarizes the results secured from tests made with the various materials, and the following notes on composition of mixtures refer to bracketed numbers appearing in the table.

(1) 1 part to 3 of olive oil. (2) 1 gm. in 2 cc. olive oil. (3) Pyrthrum extract, 2 parts; thyme, 1 part; castor oil, 3 parts. (4) Saturated solution in olive oil at 70°F. (5) Gum camphor, 3 oz.; salol, 3 oz.; petrolatum, 4 oz. (6) Oil of citronella, 1 cc.; oil of spike, 1 cc.; beeswax, 1 gm.; lanolin, 1 gm. (7) Oil of citronella, 1 oz.; spirits of camphor, 1 oz.; oil of cedar, ½ oz. (9) 1 gm. in 3 cc. olive oil. (10) 1 gm. in 3 cc. olive oil.

Since extract of pyrethrum and oil of thyme rated highest in the tests, they were mixed in equal parts with castor oil and sent to various field officers of the Division of Entomology for trial. Reports on their repellent properties were so encouraging that a series of tests was carried out to determine a satisfactory proportion combining efficiency and economy. These tests bore out previous indications of the superiority of extract of pyrethrum over thyme as a repellent and also revealed that oil of thyme is irritating to many individuals if used in any appreciable concentration. Extract of pyrethrum was then tested in various proportions with castor oil to determine the minimum concentration at which it could be used without appreciably reducing its efficiency as a repellent. This was found to be about one part concentrated extract of pyrethrum in three to four parts of castor oil. A small quantity of oil of thyme was found effective in masking the odour of the castor oil and of the kerosene in the extract of pyrethrum without causing any irritation to the user. The following formula is therefore recommended:

Oil of thyme ..... ½ fl. oz.
Conc. ext. of pyrethrum in mineral oil (ext. of approx. 1/5 lb. of pyrethrum flowers per fl. oz. of concentrate) ..... 1 fl. oz.
Castor oil ..... 2 to 3 fl. oz.

This mixture has recently been tested in various parts of Canada against mosquitoes, blackflies, punkies, and deerflies and has been found effective over periods varying from three to five hours. It is also pleasant to use and has been employed generally by many field officers of the Division of Entomology during 1938.

A few ointments incorporating extract of pyrethrum and oil of thyme, while effective for periods ranging from one to four hours, were less efficient than the liquid preparations; they were in addition oppressive to the user, and in some cases caused a burning sensation.

DISCUSSION

As indicated in the accompanying table and subsequent tests, extract of pyrethrum is the most promising of the materials tested, but it is essential that it be of good quality and known strength. The material used throughout the tests was a mineral oil extract of pyrethrum, 1 fluid ounce of which contained the extract of approximately one-fifth of a pound of pyrethrum flowers. The various forms of the essences of thyme and geranium hold definite promise. Cinnamic aldehyde and cresol, although comparatively effective, are too severe in their effects upon the skin for use in any appreciable concentrations. Phenyl saliscylate, bay laurel, pine oil, clove, and citronella, although not showing up as well as those already mentioned, possess definite value as repellents. The distillation fractions of oil of tar are all apparently fairly efficient repellents without possessing the objectionable messiness of the original material; the pigmented portion of the oil remains in the residue resulting from the distillation process. The

upper fractions resulting from the distillation of oil of tar are comparatively inexpensive and do not present the problem of deterioration found in many of the essential oils and extracts.

Materials such as citral, oil of cedar, bitter orange, geranyl acetate, and others, while giving protection over somewhat shorter periods than the materials already mentioned, nevertheless possess some value and might displace some of those already mentioned in the course of further tests. In addition to cinnamic aldehyde and cresol, already noted as being severe in their effects, thymol, citral, hedeoma, and caprylic alcohol were very irritating to the skin.

As previously mentioned, the results in the foregoing table, although indicative, are not conclusive; neither have any systematic experiments been carried out for the purpose of extending the periods during which protection is given by the more effective materials. As indicated by other workers, repetition of experiments under various conditions and at various times is requisite to conclusive data.

Reference to these studies has been made in the August, 1938, issue of the Canadian Entomologist (9) and in the annual report of the New Jersey Mosquito Extermination Association for 1938 (10). The writer acknowledges and is grateful for valued advice from Mr. C. R. Twinn, of the Division of Entomology, Ottawa, in the carrying out of these investigations.

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SOME AMERICAN SPECIES OF LUDIUS (COLEOPTERA).*

BY W. J. BROWN,
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Ludius kendalli Kby.

Ctenicerus kendalli Kby., 1837, Richardson's Faun. Bor. Am. IV. 149, pl. II. fig. 7.
Elater anchorago Rand., 1838, Bost. Jour. Nat. Hist. II, 5.
Ludius virens of American authors, not Shrank.

American records of *virens* Shrank as based on specimens of *kendalli* Kby. which is a well characterized species and not a synonym or variety of *virens* as stated by some authors. The range of *kendalli* is transcontinental, and extends from the northern limits of the subartic forests south to Maine, the Lake Superior region, the prairies, and central British Columbia. The species may be compared with *virens* as follows:

Length of male 11.5—14 mm., of female 14—18 mm. Body more robust; bronze in color; the elytra dull yellow, always with the suture very narrowly and an elongate apical spot on each purple, rarely entirely purple or greenish-purple. Antenna surpassing the posterior pronotal angle by a distance equal to the length

*Contribution from the Division of Entomology (Systematic Entomology) Department of Agriculture, Ottawa.

of one or one and one-half segments in the male, failing to attain the angle by a distance equal to the length of three or four segments in the female. Canadian and Hudsonian zones of North America..... *kendalli* Kby.

Length of male 16—17 mm.; of female 16—20 mm. Body more elongate; bright green or blue green; elytra dull yellow, the suture not darker, the elongate apical spot of each green, frequently lacking. Antenna longer, surpassing the posterior pronotal angle by a distance equal to the length of two and one-half segments in the male, attaining the angle or failing to do so by a distance equal to the length of the apical segment in the female. Central Europe. *virens* Shrank.

Ludius resplendens Esch.

Typical *resplendens*, of British Columbia and the mountains of western Alberta, is quite variable and is intermediate in its characters between eastern series and *breweri* Horn which occurs in the Sierra Nevada Mountains of Tulare and Tuolumne Counties, California. Eastern specimens are brilliant green, sometimes with feeble coppery or bluish reflections, but only rarely truly copper-colored. In British Columbian specimens, the average size is a little smaller, the specimens are sometimes green but usually entirely or partly copper-colored, and the pronotal punctures are frequently closer than in eastern examples. Some of the small, red, strongly sculptured British Columbian specimens do not differ from *breweri*. This variation seems to indicate that *breweri* and the eastern form are true, if poorly characterized, sub-species of *resplendens*, and I believe they should be indicated such. The name *aerarius* Randall (=*racinci* Chev. and *viridis* Germ. *nec* Say is available for eastern specimens. Typical *resplendens* is known to me from Crow's Nest Pass, Alta., and the following localities in British Columbia: Forbidden Plateau, Vancouver, Summerland, Vernon, Osoyoos, Fernie, Terrace, Midday Valley, Mt. Revelstoke, Otter Creek, and Trinity Valley. We have specimens of *resplendens aerarius* from Olds, Edmonton, and Elkwater, Alta; Cypress Hills and Lost Mountain Lake, Sask.; Riding Mt. Park and Aweme, Man.; Hymers, Smoky Falls, Sudbury, Nepigon, Bancroft, Westree, and Ottawa, Ont.; Maniwaki, Cascapedia, Thunder River, and Anticosti Island, Que.; Bathurst, N. B.

Ludius leucaspis Germ.

Diacanthus leucaspis Germ., 1843, Zeit. fur Ent. IV, 73.

The species here identified as *leucaspis* Germ. satisfies the original description better than does any other known to me and is the species most commonly identified as *leucaspis* in collections. It is apparently the species so identified by Van Dyke (1932, Proc. Cal. Ac. Sci., 4th series, XX, 431), but it is not closely allied to *umbripennis* Lec. which Van Dyke considered a subspecies of *leucaspis*. The species has, on the apical two-fifths of each ninth elytral interval, a row of punctures similar to the punctures of the striae and so belongs with the species I have associated together as the *edwardsi* group (1935, Can. Ent. LXVII, 3). It is allied to *edwardsi* Horn and *suckleyi* Lec. but differs from both in having the antennae long, extending well beyond the apices of the posterior pronotal angles, and the segments beyond the fifth elongate and parallel rather than triangular in form. The species may be characterized as follows:

Male. Length 10.4—11 mm. Blackish, the legs and sometimes the venter dark brown. Vestiture of the dorsum better developed than in the allied species, quite distinct on the pronotum. Antenna surpassing the apex of the posterior pronotal angle by a distance equal to the length of two and one-half segments; the third segment twice as long as and a trifle wider than the second, equal in length to and seven-tenths as wide as the fourth; the segments beyond the fifth parallel and elongate. Pronotum moderately coarsely punctate, the punctures separated by distances equal to or greater than their own diameters at middle, closer but not dense on the sides. Propleura shining, very closely punctate.

Abdomen without sexual modification. Aedeagus as in *edwardsi* and *suckleyi*. Three specimens, Logan Canon and Park City, Utah.

Ludius umbripennis Lec.

Corymbites nubilipennis Lec., 1853, Trans. Am. Philos. Soc. X, 441 (*nec nubilipennis* Germ., 1843, Zeit, fur Ent. IV. 69).
Corymbites umbripennis Lec., 1857, Rept. Expl. and Surv. Miss. to Pac. XII, pt. 3, 17.
Corymbites gracilior Lec., 1863, Smiths. Misc. Coll. No. 140, 49.

As noted above, this species is quite distinct from *leucaspis* Germ. In *umbripennis*, the elytra are usually maculate and lack the row of punctures on the ninth interval, and the propelura are not closely punctate, most of the punctures being separated by distances greater than their own diameters. In the male the body is more elongate, the pronotum usually distinctly longer than wide rather than subquadrate as in *leucaspis*, and the genitalia are characteristic. The species is not closely allied to any other known to me and is quite variable in size and color. Specimens from southern Vancouver Island and the lower Fraser valley are constantly large and have the elytra largely pale. Specimens from the central and eastern parts of southern British Columbia rarely match these, usually having the body smaller and the pale areas of the elytra more restricted. The species may be characterized as follows:

Male. Length 6.4–9.8 mm. Body elongate, moderately convex, not or feebly dilated posteriorly. Black; the legs dark brown; the elytra usually black or brown and yellow; often with the sutural interval, an elongate humeral spot, a triangular sublateral spot near middle, and an elongate apical spot dark; these spots frequently joined together and to the sutural vitta to produce a dark brown elytron with a basal, a submedian, and a post median spot yellow; the elytra rarely entirely dark brown but the epipleura always yellow. Antenna extending beyond the apex of the posterior pronotal angle a distance equal to the length of two segments; the second segment two-thirds as long as and equal in width to the third; the latter three-fourths as wide as and four-fifths as long as the fourth; the segments beyond the fifth elongate, feebly triangular. Pronotal punctures not coarse, separated by distances greater than their own diameters at middle, a little closer on the sides. Propleura shining, rather sparsely punctate. Aedeagus as figured, the lobes stouter and the tooth of each lateral lobe more distant from apex than in *leucaspis*.

Female. Body usually larger, more robust, more strongly dilated posteriorly. Pronotum as wide as or a little wider than long, more strongly convex, the sides more strongly arcuate. Antenna failing to attain the apex of the posterior pronotal angle by a distance equal to the length of the apical segment.

The large race with paler elytra noted above occurs at Saanich, Vancouver, and Steelhead, B. C. The typical form, which is usually smaller and with darker elytra, is known to us from the following localities in British Columbia: Trinity Valley, Midday Valley, Vernon, Summerland, Salmon Arm, Kamloops, Kaslo, Aspen Grove, Spious Creek, Nelson and Lac du Bois.

Ludius laricis n. sp.

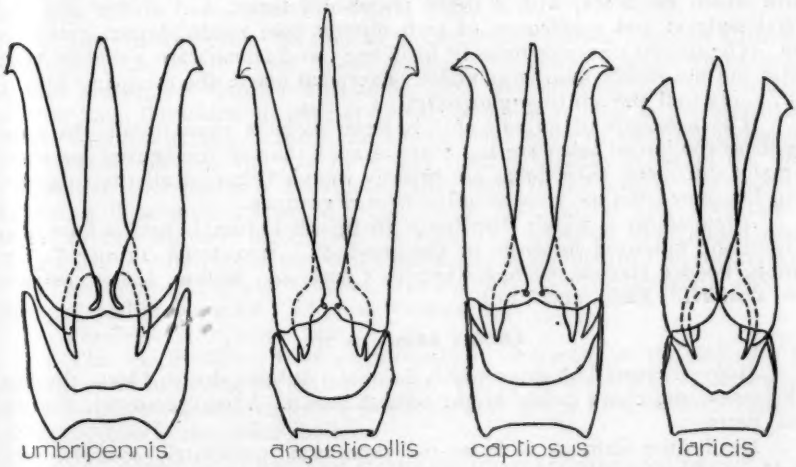
Male. Length 8.5 mm; width 2.9. Body very feebly convex. Head, pronotum at middle, posterior pronotal angles, and scutellum very dark brown; pronotal sides broadly pale red, the red areas occuping half the disk; elytra pale reddish-brown, a rather large, poorly limited basal area extending beyond the middle on the sides pale red; body beneath dark brown, the prosternal lobe, propleura elytral epipleura, antennae and legs pale red.

Head half as wide as the pronotum, flat, not distinctly impressed, closely and moderately coarsely punctate. Antenna feebly serrate; the segments less elongate but otherwise as in *rotundicollis* Say; failing to attain the apex of the posterior pronotal angle by a distance equal to the length of two and one-third

segments; the second segment was wide as long, three fifths as long as the third; the third equal in width to the second, five-sixths as long as and four-fifths as wide as the fourth; the latter three-fifths as wide as long; the intermediate segments equal to the fourth in width, decreasing slightly in length apically, all longer than wide.

Pronotum a trifle wider than long; feebly convex; the sides moderately and evenly arcuate, scarcely sinuate before the posterior angles; the latter short and stout as in *propola* Lec., not at all divergent, flat and without traces of carinae; the basal margin with a distinct incisure on each side; the disk moderately coarsely punctate, the punctures at middle separated by distances subequal to their own diameters, closer on the sides.

Elytra feebly convex, widest at apical third; the striae with moderate punctures; the intervals flat, without distinct sculpture; the lateral margins widely reflexed. Propleura moderately coarsely and densely punctate, not al-



utaceous, at base very distinctly but not deeply emarginate; the prosternal sutures not excavated. Metasternum and abdomen finely and closely punctate. Aedeagus as figured.

Female. Body frequently a little larger but its form as in the male. Antenna as in the male but a little shorter, failing to attain the apex of the posterior pronotal angle by a distance equal to the length of three and one-half segments.

Holotype—♂, Creston, B. C., October 24, 1932, (G. Stace Smith), in bark of *Larix occidentalis* Nutt., 2000 ft.; No. 4414 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—28, same data, on various dates in April, May, October, and November, 1931 to 1933.

The paratypes measure from 7.8 to 9.2 mm. In several the elytra are entirely pale red. This strongly characterized species has no close allies that are known to me. Its antennae are of the type found in *rotundicollis* and *sulcicollis* Say, and on this account, it may be associated with those species which differ in having the posterior pronotal angles strongly carinate, in lacking the incisure on each side of the pronotal base, and in numerous other characters.

Ludius angusticollis Mann.

Diacanthus angusticollis Mann., 1843, Bull. Soc. Mosc. XVI, 241.
Corymbites spectabilis Mann., 1852, Bull. Soc. Mosc. XXV, 328.
Corymbites fraternus Lec., 1869, Ann. Mag. Nat. Hist. IV, 379.

According to Leconte, the posterior pronotal angles of *fraternus*, the types of which are from Vancouver Island, are not as narrow as in *angusticollis* which was described originally from material taken at Sitka, Alaska. Van Dyke (1932, Proc. Cal. Ac. Sci. XX, 420) has placed *fraternus* as a southern subspecies of *angusticollis* and has stated that the angles are narrower in the former. I have studied the types of *fraternus* together with other material from British Columbia and a number of Alaskan specimens and have found no differences in the form of these angles or of other body parts. I believe *fraternus* must be considered a synonym of Mannerheim's species which is closely allied and confused in collections with the two species described below. *Angusticollis* may be distinguished from those and other species which it resembles by the color of its elytra which are black, with a slight plumbeous luster, and always with the lateral interval and epipleuron of each elytron pale reddish-brown except at base. The species measures from 12 to 16 mm., and females are a slightly more robust but not longer than large males. Except as noted, the following descriptions apply well enough to *angusticollis*.

The aedeagus of *angusticollis* is more variable than usual. In some specimens the lateral lobes are less acute at apex than in the figured specimen. In many specimens, these lobes are broadly rounded, but in all the subapical tooth is remote from the apex as in the figured example.

Angusticollis is widely distributed in British Columbia and is known to us from the following localities in the province: Arrowhead, Trinity Valley, Vernon, Pender Harbor, Saanich, Agassiz, Cranbrook, Nelson, Likley, Salmon Arm, Bear Hill, Kaslo, and Trail.

Ludius comes n. sp.

Male. Length 13.3 mm.; width 3.6 mm. Subcylindrical; black; the legs dark brown; the elytra rather bright reddish-brown. Vestiture silvery, distinct on all parts.

Head three-fifths as wide as the pronotum; moderately coarsely, very closely punctate. Antenna extending beyond the apex of the posterior pronotal angle a distance equal to the length of two and one-half segments; the second segment a little longer than wide, a trifle narrower than and seven-tenths as long as the third; the third segment two-thirds as wide as long, two-thirds as wide as and three-fifths as long as the fourth; the latter three-fifths as wide as long; the intermediate segments elongate, scarcely triangular.

Pronotum four-fifths as wide as long; the sides feebly arcuate; the posterior angles moderately long, moderately divergent, strongly carinate; the pronotum moderately coarsely punctate; the punctures separated by distances less great than their diameters at middle, dense on the sides. Elytral intervals flat, with fine, shallow punctures. Propleura densely punctate, shining, broadly and shallowly emarginate at base; the prosternal sutures not excavated. Aedeagus as in *angusticollis*, but with the lateral lobes broadly rounded at apex.

Female. Body a little larger and more robust than in the male. Antenna failing to attain the apex of the posterior pronotal angle by a distance equal to half the length of the apical segment; the proportions of the basal segments much as in the male.

Holotype—♂, Steelhead, B. C., June 5, 1933, (H. B. Leech); No. 4421 in the Canadian National Collection, Ottawa.

Allotype—♀, Seymour Creek, Vancouver, B. C., May 13, 1931, (H. B. Leech).

Paratypes—8 ♂, same data as holotype, May 5, 1931, and May 21 to June 5, 1933; 5 ♂, 1 ♀, Vancouver, B. C., June 5, 1930, (E. E. Peden), May 12 and 31, 1931, and June 26, 1932, (H. B. Leech); 1 ♂, 1 ♀, Courtenay, B. C., Aug. 1 and June, 1931 (Gregson); 1 ♀, Prince Rupert, B. C., June 20, 1914 (T. Wilson); 1 ♂, Mt. Hood, Oregon, July 8, 1927, (P. J. Darlington).

The Vancouver specimens were taken on Seymour Creek, Seymour Mountain (4700 ft.), and on Grouse Montain (3700 ft.). The species is not known to occur in central and eastern British Columbia. The male paratypes measure from 12 to 14.8 mm., the females from 15.5 to 18 mm. The species is closely allied to *angusticollis*, differing in the color of the elytra and in having the antennal segments beyond the third slightly but distinctly more elongate in both sexes.

Ludius captiosus n. sp.

Male. Length 13.6 to 15 mm. Black, with feeble traces of a plumbeous luster, the legs not or scarcely paler; the elytra black, their margins and epipleura not paler.

Antenna surpassing the apex of the posterior pronotal angle by a distance subequal to the length of the apical segment; the second segment three-fourths as wide as long, two-thirds as long as the third; the third segment three-fifths as wide as long, three-fifths as wide as and seven-tenths as long as the fourth; the latter two-thirds as wide as long; the intermediate segments elongate, triangular.

Pronotum with the punctures very close at middle, dense on the sides; the median line narrowly impunctate over most of its length. Aedeagus as figured, a little smaller than in *angusticollis;* each lateral lobe very broadly round or very obtusely subangulate at apex, the subapical tooth much nearer the apex than in *angusticollis.* Other characters as in *angusticollis* and *comes.*

Holotype—♂, Wallace, Idaho, May 26, 1930, (O. Huellemann); No. 4422 in the Canadian National Collection, Ottawa.

Paratypes—2 ♂, same data.

This species differs from *angusticollis* in characters of the aedeagus and antennae and in having the elytral margins and epipleura black. The antennae are a little shorter and segments two and three are a little more elongate in *captiosus* than in the allied species.

NEW BRITISH COLUMBIAN EPHEMEROPTERA*

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During the first week of August, 1938, my assistant in British Columbia, Mr. J. K. Jacob, was fortunate in being able to join a party which was penetrating into the little known and rather inaccessible mountain region west of Lytton and the Fraser river. A start was made at the junction of Kwieek Creek and the Fraser river, near the railway station of Boston Bar, about 10 miles south of Lytton; from here the route followed up the creek to Blue Lake situated at an altitude of 7000 feet, at the base of Antimony Mt., where the main camp was pitched.

The number of Ephemerids collected was relatively few on account of high winds and rather unfavorable collecting conditions. It is surprising, therefore, that amongst such scanty material four species, apparently new to science, were discovered; these are described as follows.

Ephemerella jacobi n. sp.

Male. Head deep brown; eyes (dried) blackish with slight reddish tinge. Pronotum deep brown, the lateral edges pale yellowish; mesonotum deep brown, shaded with paler laterally and posteriorly, latero-anterior edge deep blackish;

*Contribution from the Division of Entomology (Systematic Entomology), Department of Agriculture, Ottawa.

scutellum long, narrow, with palish area at base and the thin ends of the axillary cords projecting caudad beyond its apex for a considerable length (as in *tibialis* and *hystrix*). Pleura and sternum blackish, shaded with paler around bases of legs and with a large pale yellowish area cephalad of wing-base, crossed by a black line. Metathorax and abdomen blackish, the posterior edges of abdomen paler brown, giving a slight ringed appearance. Forelegs with femora and tibiae pale smoky, the tibia long and almost twice the length of femur; tarsi dull ochreous, paler than the preceding joints. Mid and hindlegs dull ochreous, the femora considerably shaded with smoky. Wings narrow, hyaline, with entirely pale and inconspicuous crossveins; longitudinal veins fine and pale brownish in costal half of wing. Tails unfortunately broken. Length of forewing, 10 mm.

Female. Head light clay-brown, somewhat deeper in color just behind the ocelli; two small median depressions filled with black and posterior to these two further short black transverse streaks. Thorax rather paler than in male but similarly marked. Abdomen deep clay-brown on terminal segments; ventral plate short, broad, apical margin gently and evenly concave, tails blackish at base, paling towards apices, faintly dark-ringed, *the median one considerably longer than the two outer ones.* Other characters as in male.

Holotype— ♂, Kwieek Cr. near Lytton, B. C. (alt. 2500 ft.), August 7, 1938, (J. K. Jacob); No. 4442 in the Canadian National Collection, Ottawa.

Allotype— ♀, same data.

Paratype—1 ♀, same data.

Evidently belongs in a group with *heterocaudata* McD. and *hystrix* Trav. (of this latter species, described from a nymph, we now have series of bred adults); it is a more slender and smaller species than *hystrix* and lacks the bright yellowish banding found in this species on the posterior portions of the abdominal sternites; in the genitalia the penes (fig. 1), among other things, are much shorter and broader.

I have much pleasure in naming the species after the collector, Mr. J. K. Jacob, who has been instrumental in the past two years in securing much interesting material from British Columbia.

Ameletus connectina n. sp.

Male. Head and thorax blackish, the pleura marked with clay-brown anterior to wing-bases and at bases of legs. Abdomen dorsally with the anterior two-thirds of segments dull dirty whitish, veined with darker and with traces of two broken subdorsal lines; posterior third of segments dull black-brown. Ventrally dirty semihyaline white on anterior segments, the rear segments being more of an alabaster-white and showing a median dark ganglionic spot. Forelegs blackish, fading into deep smoky brown on tarsi; mid and hindlegs pale dull smoky amber with blackish shadings on the femora. Wings hyaline with veins and fine crossveins dark except in costo-basal area. Forewing length, 10 mm.

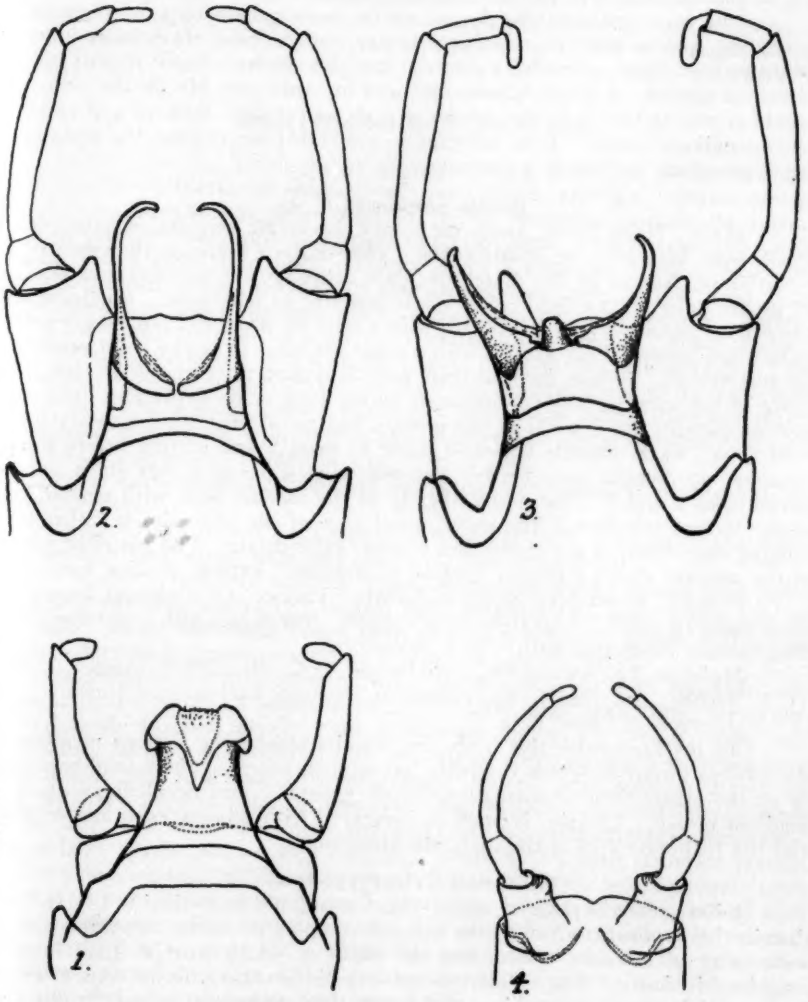
Holotype— ♂, Blue Lake, W. of Lytton, B. C., 7000 ft. August 6, 1938, (J. K. Jacob); No. 4443 in the Canadian National Collection, Ottawa.

According to genitalia (fig. 2) the species is very close to *connectus* McD., the penes being rather more incurved apically and the genital plate more elongate as compared with its width than in this species. It is considerably smaller than *connectus* and the presence of ganglionic spots on the abdomen ventrally and posteriorly would seem to separate it easily from its close relative.

Ameletus tuberculatus n. sp.

Male. Head and thorax shiny black, the latter with slight brown shading at base of scutellum on both meso- and meta-thorax; pleura shaded with deep clay-brown on the more membranous sections. Abdomen with anterior two-thirds of segments light smoky, semihyaline, strongly veined with darker; posterior third deep brown in color; traces of two submedian dark lines, not attaining

PLATE 15



Male Genitalia of 1. *Ephemerella jacobi* n. sp. 2. *Ameletus connectina* n. sp. 3. *Ameletus tuberculatus* n. sp. 4. *Baetis persecuta* n. sp.

anterior margins of segments. Ventrally pale dirty white with median row of black ganglionic marks. Forelegs blackish, mid and hindlegs dull smoky, about the same color as the abdomen dorsally. Wings hyaline, longitudinal veins brown, crossveins fine, inconspicuous and only faintly shaded with darker color. Forewing length 10 mm.

Holotype— ♂, Blue Lake, W. of Lytton, B. C., 7000 ft., August 4, 1938, (J. K. Jacob); No. 4444 in the Canadian National Collection, Ottawa.

The male genitalia (fig 3) are of the same general type as those of the preceding species but the penes are shorter and between their bases is a very characteristic large tubercle, a feature not heretofore found in any of our *Ameletus* species. A single female, captured on Antimony Mt. on the same date, would appear to belong to this species as it shows the same dull color of abdomen with ganglionic marks. It is, however, considerably larger than the male and I have, therefore, not made it the allotype.

Baetis persecuta n. sp.

Male. Head black, antennae smoky, turbinate portion of eyes (dried) small, oval, blackish with ruddy edges. Thorax deep blackish, the edges of the metathorax, laterad of the scutellum, pale ochre-brown; membranous portions of pleura paler with a light ochre streak anterior to wing-base. Abdomen with the *first six segments hyaline whitish* with a faint smoky tinge, posterior segments light wood-brown. Legs whitish with a slight suffusion of smoky, most prominent on fore femora. Wings hyaline with pale venation; intercalaries in first interspace of forewing very weak; hindwing rather long, with upper and lower margins subparallel (as is usual in this group) and costal projection well-developed; vein 3 very weak, scarcely traceable, close to margin and ending before middle of same; no definite intercalaries (on one wing trace of a very short one between veins 2 and 3). Genitalia (fig. 4) of the *moffati* type, with second joint of the forceps cylindrical; the inner apical edge of the first joint is rather more bulging than usual in the group, but scarcely tuberculate. The posterior margin of the segment shows a narrow median excavation. Length of wing 6 mm.

Female. Head deep chocolate-brown. Thorax and abdomen brown, the latter paler ventrally. Legs light smoky amber. Forewings with crossveins tinged with brown; hindwings with vein 3 obsolescent.

Holotype— ♂, Kwieek Cr., near Lytton, B. C., alt. 2500 ft., August 7, 1938, (J. K. Jacob); No. 4445 in the Canadian National Collection, Ottawa.

Allotype— ♀, same data.

To my knowledge this is the first species among the western members of the *moffati* group in which the male has whitish anterior abdominal segments; in all the others these segments are tinged, generally very decidedly, with some shade of brown. The size is small as compared with *jesmondensis* and *moffati*, and the turbinate eyes of the male are quite small.

Genus **Tricorythodes**

I have already pointed out (1931, Canadian Entomologist, LXIII, 267) that in the *explicatus* group there exists a complex of forms, extending over a wide range of territory, concerning the status of which workers have been in considerable doubt. The differences between these various forms consist largely in size and intensity of markings and color; there appear to be no definite genitalic differences nor can one point to anything very distinctive in the maculation pattern which could be construed as representing a specific character. In consequence, in my above mentioned treatment of the group, I lumped the forms under the one name, *explicatus* Eaton, and contented myself for the time being with noting such slight points of variation as existed. Later Dr. Traver (1935, Biology of Mayflies, 634) limited the name *explicatus* to the large dark species occurring in Texas and the adjoining regions and proposed (and I believe cor-

rectly so) the name *fallax* for a somewhat paler species from California; her remarks following this description show that she was still puzzled as to where to place the smaller forms from Wyoming, Alberta, Saskatchewan and the East, mentioned by me in my earlier article, and they were very tentatively included under *fallax*. I have recently had the opportunity of examining a long series of specimens (both dried and in alcohol) in excellent condition from Williams Lake, B. C., captured by G. S. Walley. These are all very uniform in size and correspond in this respect with my Alberta series and also with specimens from Washington and Oregon; under such circumstances I believe a name to be justified and propose the following one for this smaller more northerly species.

Tricorythodes fallacina n. sp.

Male. (dried) Head and prothorax dull black, faintly shagreened, the two lateral ocelli black, the median one shiny white; antennae whitish, smoky toward base. Mesothorax shiny blackish, paling somewhat towards the lateral posterior portions; membranous portions of pleura smoky olive-brown. Abdomen blackish with a slight silky sheen, posterior edges of segments faintly ringed with light olive-brown, lateral portions of median segments only slightly paler than dorsum; ventrally uniformly deep smoky, somewhat paler than dorsally. Forceps with basal joints whitish, terminal ones suffused with smoky. Setae whitish, tinged basally with smoky and with faint, fine, dark intersegmental rings. Legs deep smoky, the tibiae and tarsi paler than the femora; these latter, especially on the mid and hindlegs, show the upper and lower edges narrowly black. Wings hyaline with the two longitudinal veins below costa, as usual, strongly defined in deep smoky. Length of wing, 3½–4 mm.

From an alcohol specimen the following more detailed description has been drawn up.

Head. Deep brown with posterior edge narrowly blackish; ocelli white with blackish basal rings; antennae pale with dark second joint.

Thorax. Prothorax dorsally largely deep dull smoky brown with paler tinges laterally and posteriorly; ventral area, between and around first pair of legs, pale. Meso- and meta-thorax deep shiny pitch black; pleura and sterna similarly dark with membranous lateral portions pale brownish.

Abdomen. Dorsally deep brown, heavily sprinkled with blackish; segments I, II, VIII and IX entirely covered by this black sprinkling; other segments broadly blackish dorsally, the dark color extending laterally fully half the distance between mediodorsal line and lateral edge, leaving a comparatively small lateral area free from this sprinkling. Lateral edge paler than rest of body; at times traces of paler median line. No distinct pale transverse banding but in fully distended specimens the paler visible intersegmental membrane gives a faint appearance of such banding. Segment IX with posterior margin distinctly dull whitish; X lighter brown with postero-lateral portions and entire rear end whitish, the posterior plate darker brown. Ventrally deep brown with the usual minute pale lateral streak and pair of median dots on each segment; posterior third of segment IX, genital-plate and forceps whitish, the pale color extending forward on IX in a V-shaped median area, attaining anterior margin. Posterior edge of genital-plate and second joint of forceps tinged with smoky; penes largely smoky. Genitalia as in *explicatus*. Setae pale, tinged with blackish on basal segments, faintly dark-ringed.

Forelegs. Trochanter deep smoky; femur pale whitish on inner side with exception of ventral edge, dorsal edge at base, apical margin and an apical longitudinal short streak, which are smoky brown; outer side with pale area reduced to a longitudinal streak and a curved streak arising near base and extending narrowly along dorsal margin, the dark areas comprising the basal third

dorsally, the entire ventral margin except at extreme base and a long spindle-shaped patch, occupying most of the remaining two-thirds. Tibia with distinct narrow blackish ring at base, pale dull whitish, tinged fairly strongly with brown in basal one-half. Tarsi whitish with very faint brown ring at base and tinges of brown on claw-segment.

Mid and Hindlegs. Coxae and trochanters deep brown. Femora dull whitish with blackish dorsal and ventral edges and a narrow dark longitudinal central streak extending entire length of joint. Tibiae pale, narrowly blackish at base, this color extending shortly along ventral edge and more extendedly along dorsal edge. Tarsi pale, faintly brown-tinged. Hind tibiae tinged with brown in apical half dorsad of dark streak.

Holotype—♂, Williams Lake, B. C., July 12, 1938, (G. S. Walley); No. 4446 in the Canadian National Collection, Ottawa.

Paratypes—23 ♂ (dried) and a vial of alcohol material, same data.

NEWS AND VIEWS

THE NATIONAL PLANT BOARD OF THE UNITED STATES

At the fourteenth annual meeting of the National Plant Board of United States held at New Orleans, Louisiana, on September 16 and 17, 1938, the pink boll-worm of cotton was discussed and the gravity of the situation impressed on the members by Dr. Lee A. Strong. The white-fringed beetle, an introduced species, was also under discussion and the placing of a federal quarantine to aid in the control of this species proposed.

DEATH OF DR. C. J. GAHAN

Dr. Charles Joseph Gahan, Keeper in the Department of Entomology in the British Museum (Natural History) from 1913 to 1927, died on January 21. He was seventy-seven years of age. He served the Entomological Society of London as Honorary Secretary in 1899 and 1900 and as President in 1917 and 1918.

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